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Final Report

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Dr Koenraad Mauthaan

National University of Singapore

Exploratory Research and Development of Microwave Filters in Silicon Technology

Abstract

The objective of the project is to explore topologies and techniques to realize microwave filters in a standard silicon process. A wideband differential-mode combline filter with a tapped-line input is presented. High suppression of the common-mode and a small size are two important features of the proposed filter. The filter combines two conventional combline filter connected together through discrete capacitors. The realised sixth-order balanced combline filter has a 3 dB bandwidth of 74% from 0.88 to 1.9 GHz. The common-mode suppression is larger than 29 dB, even up to 5 GHz. Furthermore, the filter core size ($0.026 \lambda^2(g)$) is substantially smaller than previously reported wideband balanced filters.

Summary

Advanced radar systems and military communication systems require a high level of signal filtering, especially under jamming conditions. Microwave filters play a crucial role and traditionally the filters are realized using printed circuit techniques on substrates. There is currently a lack of high-Q filters available in silicon technology. As a result, filters are incorporated off-chip leading to design limitation, lower performance, and bulkier circuit designs. There is a strong trend to realize transceiver front-ends in silicon integrated circuits, which necessitates the integration of the microwave filters in silicon too.

The project explores topologies and techniques to realize high-Q microwave filters in a standard silicon process. An L-band filter and a Ka-band filter and both active and passive topologies are considered.

A wideband differential-mode combline filter with a tapped-line input is presented. High suppression of the common-mode and a small size are two important features of the proposed filter. The filter combines two conventional combline filter connected together through discrete capacitors. The realised sixth-order balanced combline filter has a 3 dB bandwidth of 74% from 0.88 to 1.9 GHz. The common-mode suppression is larger than 29 dB, even up to 5 GHz. Furthermore, the filter core size ($0.026 \lambda^2(g)$) is substantially smaller than previously reported wideband balanced filters.

Details are provided in:

Wideband balanced combline filter with extended common-mode suppression

Author(s): Taslimi, A. ; Mauthaan, K.

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